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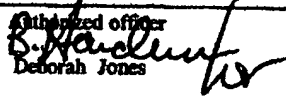
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

| | | |
|---|---|--|
| Applicant's or agent's file reference 0035-ET-PCT | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
| International application No. PCT/US01/24587 | International filing date (day/month/year) 02 August 2001 (02.08.2001) | Priority date (day/month/year) 03 August 2000 (03.08.2000) |
| International Patent Classification (IPC) or national classification and IPC IPC(7): B32B 9/00; C30B 29/32 and US Cl.: 117/949; 428/697,699, 700, 701,702 | | |
| Applicant MICROCATINGS TECHNOLOGIES, INC. | | |
| <p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>3</u> sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of <u>1</u> sheets.</p> <p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of report with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input type="checkbox"/> Certain defects in the international application VIII <input type="checkbox"/> Certain observations on the international application | | |
| Date of submission of the demand 31 January 2002 (31.01.2002) | Date of completion of this report 18 September 2002 (18.09.2002) | |
| Name and mailing address of the IPEA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230 | Authorized officer  Deborah Jones Telephone No. 703-308-0661 | |

Form PCT/IPEA/409 (cover sheet)(July 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/US01/24587

1. Basis of the report

1. With regard to the elements of the international application:*

- ☐ the international application as originally filed.
- ☒ the description:
pages 1-8 _____ as originally filed
pages NONE _____, filed with the demand
pages NONE _____, filed with the letter of _____.
- ☒ the claims:
pages NONE _____, as originally filed
pages NONE _____, as amended (together with any statement) under Article 19
pages NONE _____, filed with the demand
pages 9 _____, filed with the letter of 16 AUGUST 2002 (16.08.2002)
- ☒ the drawings:
pages 1 _____, as originally filed
pages NONE _____, filed with the demand
pages NONE _____, filed with the letter of _____.
- ☐ the sequence listing part of the description:
pages NONE _____, as originally filed
pages NONE _____, filed with the demand
pages NONE _____, filed with the letter of _____.

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☒ The amendments have resulted in the cancellation of:

- ☒ the description, pages NONE
- ☒ the claims, Nos. NONE
- ☒ the drawings, sheets/fig NONE

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US01/24387

V. Reasoned statement under Rule 65.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

| | | |
|-------------------------------|-------------|-----|
| Novelty (N) | Claims 1-16 | YES |
| | Claims NONE | NO |
| Inventive Step (IS) | Claims 1-16 | YES |
| | Claims NONE | NO |
| Industrial Applicability (IA) | Claims 1-16 | YES |
| | Claims NONE | NO |

2. CITATIONS AND EXPLANATIONS

Claims 1-16 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest a $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{TiO}_3$ formed as a layer on the C-plane of a sapphire substrate, wherein x has a value of 0 to 1.

Claims 1-16 meet the requirement of industrial applicability as defined by PCT Article 33(4), because the claimed invention has applicability in the electrical and optical device fields.

NEW CITATIONS



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
PATENT COOPERATION TREATY
INTERNATIONAL SEARCHING AUTHORITY

Applicants: Schmitt et al.

Att. Docket No. 0035-ET-PCT

For: ELECTRONIC AND OPTICAL MATERIALS

Application No. PCT/US01/24587

Filed: 2 August 2001



24948

PATENT & TRADEMARK OFFICE

Response to International Search Report

Assistant Commissioner for Patents
Box: PCT
Washington D.C. 20231

Sir:

In Response to the International Search Report dated 27 December 2001, attached is Substitute Sheet, page 9, containing substitute claims 1-16.

Claim 1 in the substitute sheet is directed to epitaxial Barium Strontium Titanate (BST) on c-plane sapphire, BST ranging from barium titanate to strontium titanate and the mixed oxides. Although the Examiner has cited references showing epitaxial strontium titanate on r-plane sapphire, he has not cited references showing epitaxial barium titanate, epitaxial strontium titanate, or (the mixed oxide) epitaxial barium strontium titanate on c-plane sapphire. Accordingly, Claim 1 has novelty over all of the cited references.

Claim 8 in the substitute sheet is directed to epitaxial BST where the atom ratio of Ba to Sr ranges from 10:90 to 90:10. Although the Examiner has cited references showing epitaxial strontium titanate on sapphire, no references has been cited showing the epitaxial mixed oxide, barium/strontium titanate. Accordingly, Claim 8 has novelty over all of the cited references.

Neither of the Azuma et al. references, 5,612,082 or 5,624,707 describes deposition of epitaxial layers.

In Kashiwara et al., 5,572,052, PZT and PZLT layers are grown, sapphire being a suggested substrate; however, deposition of epitaxial barium titanate, strontium titanate or BST on sapphire are not shown or suggested.

In Neuman et al., 5,132,282, epitaxial strontium titanate (not mixed Ba/Sr titanate) is grown on r-plane (or "plane {1102}) sapphire. (Col. 6, line 3) The same is true of Neuman et al. PCT/US92/01788. (P. 9, line 22)

There is no teaching or suggestion in the Tsuzumi abstract, JP 11031921, that the deposited layers are epitaxial.

Like the Neuman et al. references, the Desu et al. reference, EP 0630424, describes deposition on r-plane sapphire. The 3.5 Angstrom lattice spacing is the distance between planes in r-plane sapphire (P. 10, line 20)

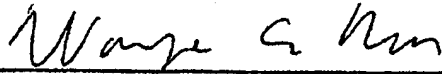
Not only do Claims 1 and 8 exhibit novelty over the cited prior art, but they represent an inventive step.

Regarding Claim 1, previously, strontium titanate had been grown on the r-plane of sapphire. The titanates to which the present invention is directed have a cubic structure, thus the tetragonal configuration of the r-plane is an apparent match for depositing epitaxial titanates of cubic structure. On the other hand, the c-plane is hexagonal and not an apparent lattice match for cubic titanates. In fact, in accordance with the invention, c-plane sapphire is found to be advantage for epitaxial growth, producing higher yield and improved performance. The c-plane of sapphire also has advantages in respect to patentability.

Regarding Claim 8, the mixed oxide, barium strontium titanate, is a more complex oxide to deposit than strontium titanate, introducing an additional cation. Furthermore, the lattice structure of BST is changed in dimension relative to strontium titanate; accordingly, just because strontium titanate can be deposited epitaxially on sapphire, it would not be known that BST could be epitaxially deposited. BST has different electrical characteristics than strontium titanate and is therefore desired for certain electrical applications, particularly as a dielectric material.

For the above reasons, it is believed that the invention, as recited in Claims 1 and 8, is novel and represents an inventive step.

30 January 2002



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Atlanta, GA 30341-2107, U.S.A.

What is Claimed:

1. A material comprising epitaxial $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ formed as a layer on the C-plane of a sapphire substrate, wherein x has a value from 0 to 1.
2. The material of Claim 1 wherein said layer is between about 100 and about 3000 nanometers thick.
3. The material of Claim 1 wherein said layer is between about 300 and about 1000 nanometers thick.
4. The material of Claim 1 wherein said $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ has a 111 orientation.
5. The material of Claim 1 wherein said $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ is doped with an ion or ions that change its properties.
6. The material of Claim 5 wherein said doping ions comprise cesium and bismuth.
7. The material of claim 1 further comprising conductive electrodes for applying a bias or RF signal to the $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ layer.
8. A material comprising epitaxial $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ formed as a layer on a sapphire substrate, wherein x has a value from 0.1 to 0.9.
9. The material according to Claim 8 wherein x has a value from 0.3 to 0.7.
10. The material according to Claim 8 wherein x has a value from 0.4 to 0.6.
11. The material of Claim 8 wherein said layer is between about 100 and about 3000 nanometers thick.
12. The material of Claim 8 wherein said layer is between about 300 and about 1000 nanometers thick.
13. The material of Claim 8 wherein said $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ has a 111 orientation.
14. The material of Claim 8 wherein said $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ is doped with an ion or ions that change its properties.
15. The material of Claim 14 wherein said doping ions comprise cesium and bismuth.
16. The material of Claim 8 further comprising conductive electrodes for applying a bias or RF signal to the $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ layer.